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Reeling device.

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The present invention relates to a reeling device, allowing to reel in or unreel without twisting a flexible link, the extremities of which are fastened to attachment points that can vary in relative position.

The presently known reelers comprise essentially a drum functioning as a winch; in these devices, one of the extremities of the flexible link participates in the rotation of the drum. On the contrary, the device that is the object of the invention has mainly as goal of allowing the reeling of the link without any of its extremities being driven by the rotation of elements; said extremities can therefore invariably be fastened to supports that are mobile relative to each other.

The reeler that is the object of the invention is essentially characterized by having two drums with the same axis, one of which is stationary and receives one of the extremities of the flexible link, the latter winding itself on the other mobile drum rotating on its axis; the motor force necessary to produce the winding is applied to a support rotating around the common axis of the two drums, this support guides the flexible link between the fixed drum and the mobile drum, in a manner that causes the winding of the link on the stationary drum, at the same time as on the mobile drum.

The attached drawing shows, only as example, three execution forms of the device that is the object of the invention.

Figures 1 to 9 relate to a first execution form. Figure 1 is a front view, figure 2 is a side view according to section A-A in figure 1; figures 3 to 9 are side views related to variants.

Figures 10 to 18 are related to a second execution form; figure 10 is a front view; figure 11 is a side view according to section B-B in figure 10; figure 12 is a partial front view; figures 13 and 14 are side views of sections; figure 15 is a partial front view of another variant, and figure 16 is a side view related to this figure 15; figures 17 and 18 are related to mounting details.

Figure 19 is a cross section of one variant.

In the example of figure 1, a shaft 1 mounted in bearings solidly connected to a stationary frame 2 supports two cylindrical drums 3 and 4. These drums are mounted free

spinning on the shaft, but drum 3 is installed stationary on the frame, and consequently immobile, while drum 4 spins freely. Between the two drums, a round plate 5, keyed or mounted with a press fit on the shaft, has an opening 6 intended for passage of the cable. The figure 2 section is assumed to be made through the middle of drum 3. The cable is attached to the frame and secured in 7 on the surface of drum 3. The free strand passes through opening 6. If then this string is stretched in any direction, the rotation of the plate around the shaft has as effect that the cable is wound on the two drums at the same time, the fixed strand on the stationary drum and the free strand on the mobile drum. This rotation can be obtained by the action of a handle or any other means.

While winding up, the cable glides through the opening of the plate and drives the mobile drum that is also rotating around the shaft, in the same direction.

If the drum radii are equal, it is easy to verify that, except for sliding, the mobile drum makes two rotations for one rotation of the drive plate. More in general, if:

r is the radius of drum 3;

r_1 , the radius of drum 4;

u ,the angular velocity of the drive plate, the velocity of the mobile drum is:

$$u_1 = u\left(1 + \frac{r}{r_1}\right)$$

The drums are appropriately curved for the windings to slide naturally towards the median parts.

Opening 6 can be replaced by a simple slot (fig. 3), and the plate by a simple lever foreseen of the opening or slot (fig. 4).

To avoid sliding of the cable, a ball bearing can be mounted in the opening or slot with its axis parallel to the shaft. A return pulley (fig. 5), appropriately curved, can also be mounted in the opening with its axis directed according to a radius, or even simpler the plate can be replaced by a lever forming one piece with the axis of the return pulley (fig. 6). The axis of the pulley can also be parallel to a diameter of the plate (fig. 7) or inclined in such manner as to cross the cable under a convenient angle (fig. 8).

Finally, the axis of the return pulley can be parallel to the axis of the drums and mounted in a fork in the opening of the plate, or at the extremity of a straight or by preference elbow shaped lever in order to better clear the cable (fig. 9).

The equipment comprises a device allowing regular unwind of the cable by pulling the free strand. The cable must indeed remain taut, mainly in the parts contained between the plate and the drums. This result can be obtained by applying, during the unwinding, an antagonist force that tends to brake the rotation of the plate.

On the drive plate or lever a spiral spring, for instance, can be mounted that always exercises force in the winding direction, in order to stretch the cable on both sides of the plate (or lever). The device can be completed by a pawl clutch or analog type, that allows winding only when the pawl is raised. The rotations determined by the funicular connection constituted by the flexible link can also be linked through a planetary gear train.

Instead of a spring, a counterweight can be used actuating a cable wound on an auxiliary drum solidly connected with the drive plate or lever, in this way forced in the

direction of winding. One or the other device will be used according to the nature of the applications. A simple brake can also be used.

The execution form shown in figures 10 to 18 differs mainly from the preceding in that the mobile drum envelops the stationary drum, the rotating support guiding the flexible link between the two drums being constituted by the mobile drum itself.

In a hollow shaft 1 solidly connected to a fixed frame 2 is keyed or sleeved with a press fit a cylindrical drum 3. A radial conduit 15 passes through the shaft and the drum to provide a passage for cable 16 the extremity of which is attached to any point of the frame so that it acts as if the cable were secured in 17 on the surface of the drum. For the clarity of the drawing, the cable is not shown in figure 10.

Two cylindrical plates 5 are mounted free spinning on both sides of the drum and are braced by a series of shafts 18 installed in a carrier housing according to the generating lines equidistant from a cylinder concentric with the drum. On each of these shafts is mounted freely spinning a bearing roller 19.

If by an appropriate means, handle or any other the assembly of the two plates is rotated in the direction of arrow 20 (fig. 11), and the free strand of cable is stretched in any direction, the first roller 19 that crosses the cable drives it by its movement, so that the secured strand winds around the drum, and the free strand around the roller ring, following a contour that is approximately circular, and more perfect as the rollers are more numerous and closer to each other. In practice, 6 to 8 rollers suffice to ensure regular winding, without discernible shocks.

If: r is the radius of the drum

r', the radius of each roller

u, the angular velocity of the two drive plates, it is easy verified that, except for sliding, the cable transmits to the rollers a real rotating motion with a velocity which is, relative to the respective axes:

$$u' = u\frac{r}{r'}$$

On the other hand, the angular velocity of the fictitious cylinder with radius r_1 that constitutes the outside envelop of the rollers is:

$$u_1 = u + u'\frac{r'}{r_1} = u(1 + \frac{r}{r_1})$$

As in the preceding example, the apparatus comprises a device allowing to unwind the cable regularly by pulling the free strand; the same arrangements that were used previously for this purpose.

The dimensions of the apparatus, the shape of the frame, the constituting materials of the elements and the fabrication details and accessories vary with the nature of the applications, from small cable reelers for suspended or portable lamps, to cable reelers for high power motors, or for tubes transporting liquids and free or compressed gases.

The relative dimensions of drum and rollers depend on the flexibility of the cable that must be easy to wind without deterioration on the drum and the return roller. The surface of the rollers, instead of being cylindrical, can be curved to facilitate the sliding of the windings towards the middle (fig. 12). But it is not necessary to make all rollers like that. Two or three rollers made in such way is in general sufficient for stowage, and the intermediate ones can be simple cylindrical guides devoid of protruding cheeks. Furthermore, to avoid elbowing the cable in a too small radius, the return roller or guide can have a larger diameter, its surface remaining tangential to the cylinder enveloping the ring. Figure 12, shows the view, shown in front view, and figure 13 the transversal section of a reeler with a ring comprising three curved rollers and 3 cylindrical guides, the return guide having a larger diameter.

An eccentric return guide can also be foreseen inside the ring, as shown in figure 14.

Instead of two plates, it is possible to have only one, the axes of the rollers being cantilevered, or simply connected by an annular ring on the side opposite to the unique plate (fig. 15 and 16). In the last case, the shaft can be solid, the cable passing between the drum and the rollers, on the opposite side of the plate.

In small apparatus, the rollers can be solidly connected by resting with their axes in pivots arranged in ring form on the two plates that are conveniently braced (fig 17), or can even be reduced to simple cylindrical guides in pivots (fig. 18).

A variant execution form, shown in figure 19, is constituted in the following way: Cable 16, intended to be wound on fixed drum 21, passes for instance through axial hole 22 and radial hole 23; this cable must be immobilized in translation, as in all the preceding examples. Cable 16 is then wound on part 22a of roller 22, in the direction shown in figure 19 for instance; the number of windings to be wound on part 22a is determined in function of the length of cable to be wound. Cable 16 passes then over part 22b via slot 22c for instance, and is wound on part 23a of drum 23, in the direction opposite to the winding on drum 22a and with a corresponding number of windings. The cable arrives finally at part 23b that constitutes the real winding drum. Drum 23 rotates around axis 21a, stationary, and roller 21 rotates around axis 24 solidly connected to plate 25 that can rotate around axis 21a. It is on this plate that the motor force is applied to produce the winding.

If this plate is first rotated towards the back of the drawing plane (relative to the upper part of the plate) the cable tends to wind itself on the fixed drum, which provokes the rotation of roller 22. Because of its rotation and gyration, part 22b tends to reel in the cable, which forces the latter to unreel from part 23a, making drum 23 turn, which produces the reeling of the free strand on part 23b.

The unwinding occurs by acting in the opposite direction on drum 23, a light antagonist force (spring, brake) tends to maintain plate 25 in its rotation in order to avoid the creation of slack.

The preceding arrangement can be subject to variants in winding and dimensionally; it is sufficient that drum 21, roller 22 and drum 23a constitute a planetary train with ratio different from 1 for the described device to function. This execution form offers the advantage that the flexible link is not subjected to any friction in the device, not even rolling friction, because it unwinds from one drum to wind itself on another, without passing over rollers.

The totality of the mechanism, in the three described execution forms, can be lodged in a housing or box. The shape of the frame depends on the position occupied by the device, which can be mounted on a horizontal frame, or suspended from the ceiling, where all particulars common to all reeling systems are applied.

An analog variant can be created in the case of a mobile drum enveloping the stationary drum. This mobile drum can consist of a hollow cylinder enveloping the rollers ring on which the link is wound a few turns beforehand. The link passes then through an opening, from the interior to the exterior of the cylinder surface on which it winds itself, while the portion previously wound on the rollers unwinds simultaneously and proportionally.

More in general, no matter which system is employed, the mobile drum can always be made in two parts of different diameter, of which the first regulates the winding speed in function of the driving; the second being determined by considerations of convenience and envelop.

The application of the reeler, described above in its three execution forms, is indicated for all transmission of energy by means of flexible conductors, in particular electrical transmission for lighting, drive force, signalization, telephone, or other, hydraulic and pneumatic transmissions for machine tools and other equipment, simultaneous transmission of electrical currents and fluids of any kind, circulating in conductors that can be collected in bundles.

SUMMARY

1. Reeling device, essentially characterized by comprising two drums with the same axis, one of which is stationary and receives one of the extremities of a flexible link, this link winding itself on the other drum, mobile in rotation around its axis; the motor force necessary to produce the winding is applied to a support rotating around the common axis of the two drums, this support guiding the flexible link between the fixed drum and the mobile drum, in a manner that produces the winding of the link on the fixed drum at the same time as on the mobile drum.
2. Execution forms of the device according to 1, characterized by:
   a) The mobile drum enveloping the fixed drum, the rotating support guiding the flexible link between the two drums being constituted by the mobile drum itself.
   b) The guide of the flexible link, mounted on the rotating support, is constituted by a roller.
   c) The guide of the flexible link receives the cable that winds itself on it, then in the opposite direction on the mobile drum in a number of windings that depends of the length of the free strand to be wound, this free strand winding itself on the mobile drum without any kind of friction of the flexible link on any element of the device.

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